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Europäisches Patentamt  
European Patent Office  
Office européen des brevets

(11) Publication number:

**0 174 755**  
**A1**

(12)

# EUROPEAN PATENT APPLICATION

(21) Application number: 85305906.1

(51) Int. Cl.<sup>4</sup>: **E 01 C 13/00**  
**E 01 C 9/08, E 01 C 15/00**  
**E 01 C 9/00**

(22) Date of filing: 20.08.85

(30) Priority: 25.08.84 GB 8421655  
25.08.84 GB 8421659  
22.02.85 GB 8504667

(43) Date of publication of application:  
19.03.86 Bulletin 86/12

(84) Designated Contracting States:  
AT BE CH DE FR GB IT LI LU NL SE

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(54) Pedestrian, vehicular, or sports playing surfaces and underlays/shock pads.

(57) An artificial turf or underlay/shock pad for an artificial turf or similar surface is prepared using as one layer an open fibrous structure (2-4) made of synthetic material having vertical (4), horizontal (3) and angularly inclined (4) fibres the open fibrous structure being filled with a particulate material (5,6) such as sand or soil to produce a composite structure having a desired compressibility. The open fibrous structure (2-4) enables the particles (5,6) to move with the fibres (4) when pressure is applied in almost any direction and to "spring" back again. The composite open fibrous structure (2-4) is therefore suitable either as an underlay for an artificial turf of conventional design or as an artificial surface on its own. When used as an artificial surface laid on soil natural grass may be seeded into the particulate material and is able to grow through the base of the open fibrous structure (2-4) to root into the soil.

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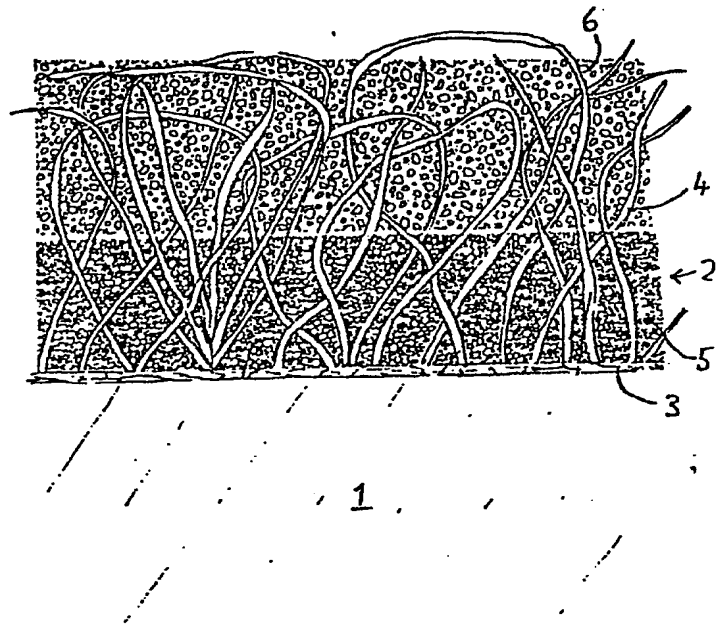


Fig. 1

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PEDESTRIAN, VEHICULAR, OR SPORTS PLAYING SURFACES AND  
UNDERLAYS/SHOCK PADS

This invention relates to a method of forming a pedestrian, vehicular or sports playing surface or underlay/shock pad.

According to the invention a method of forming a  
5 pedestrian, vehicular or sports playing surface or underlay/shock pad comprises providing a layer of an open fibrous synthetic material, and distributing a particulate material throughout the fibrous material so that the compressibility of the fibrous material is  
10 reduced.

The particulate material is suitably a fine aggregate material such as sand or soil, or a synthetic particulate material, for example of plastics or rubber. Peat or other organic growth-supporting materials may  
15 also be used. The particles applied are suitably sized at 0.125 to 3 mm for rubber or the like and 0.125 to 5 mm for sand, which is most suitably of rounded grains, although for certain applications, such as cricket pitches and vehicular surfaces, angular particles are  
20 preferable. For soil, the minimum particle size will be substantially smaller than 0.125 mm. A combination of filler particles may be used, for example rubber particles and sand in distinct layers, or even uniformly mixed to achieve the desired characteristics of ball  
25 bounce, for example, in a sports playing surface.

The fibrous material is preferably a polyester or polypropylene fibre wadding formed by distributing fibres randomly in a layer and then needle-punching the layer to bind the fibres together, followed by at least one  
30 further needling operation in which fibres are pushed through the layer so as to extend from one face thereof, while remaining anchored at one end in the layer. The wadding resulting from such an operation may thus have

initially 50% to 75% of the fibres vertical or substantially vertical, some fibres extending obliquely, and the remainder horizontal or substantially horizontal. The horizontal or near-horizontal fibres may form a layer  
5 at one face of the wadding, giving a pile carpet-like structure on the opposite face. The initial air space in the wadding represents about 35% to 80% by volume of the wadding. A suitable wadding can be formed from a mixture of fibres, comprising 10% to 30% of 10 to 30 denier  
10 fibres, for example polypropylene, and the balance of about 100 to 150 denier fibres. Fibres in excess of 150 denier in particular in the range 150 to 300 denier may be desirable for specific surfaces but there are difficulties in needle punching as the fibre weight  
15 increases which make it difficult to produce a good open fibrous structure. Fibres in the intermediate range 30 to 100 denier may be used in substitution for or in mixture with the other fibre ranges.

The thickness of the wadding is preferably 4 mm to  
20 37 mm, more preferably at least 12.5 mm, and the density is preferably from 0.25 to 1.2  $\text{kgm}^{-2}$  for an 18 mm thick wadding. The wadding may contain some resin as a binder.

A further material may be placed on top of the filled wadding, for example a synthetic turf material,  
25 but the surface may be usable without any additional materials.

Alternatively, the fibrous material, when covered with another surface material, may be a tufted carpet material formed from synthetic materials such as  
30 polypropylene or polyester fibres or strips.

One aspect of the invention provides a method which further comprises introducing grass seed into a particulate growth medium within the wadding so that grass may be cultivated therein. Although it is known to  
35 use plastics reinforcing meshes and the like to reinforce

a turf surface, many of these systems result in the growth nodes of the grass lying on the surface, where they are more readily damaged. With the method of this aspect of the present invention, the growth nodes are  
5 within the surface and, as these and part of the aerial growth are protected by the filled wadding, a more durable turf may be formed. This method may be adapted to produce turf to be laid at another location. The wadding with growth medium filler is laid on a suitably drained,  
10 but preferably non-growth supporting surface, e.g. of concrete, and when the grass has grown to the desired density the resultant turf can be rolled up for transport.

In a preferred method of preparing a mixed natural  
15 and synthetic turf, or a reinforced material turf, the area to be turfed is excavated to a depth of, for example, 45 to 100 mm below the desired surface level. A lining of water-permeable membrane, for example formed from needle-punched, resin-bonded, synthetic fibres, is  
20 placed in the excavation, and a layer of sand 25 to 80 mm thick is introduced. Wadding approximately 18 mm thick is laid on to the sand and a soil-or peat-based particulate growth medium or sand is introduced into the wadding and seeded with grass seed. With suitable  
25 feeding and watering, a strong reinforced turf surface can be produced, which is suitable for use as a hard-wearing sports surface.

The method of the invention is simple and economical and provides a stable surface suitable for a variety of  
30 uses such as footpaths, roads, especially temporary roads, sports playing surfaces and decorative turf areas in locations susceptible to erosion or instability. The surface formed by the method of the invention may also be used to provide a sports playing surface of predetermined  
35 playing characteristics, such as ball bounce, the

characteristics being chosen by varying the position of the layer of wadding in the structure of the surface, and the particulate material used to fill the wadding.

Another aspect of the invention provides a pile  
5 carpet, preferably comprising bonded needle-punched synthetic fibres with a bonded backing layer, and resilient particles, e.g. of rubber, introduced into the fibre pile of the carpet.

It has been found that such a carpet is cheap to  
10 manufacture and has an extended life in comparison with conventional carpets, particularly in use as a sports playing surface where spiked shoes are used. In such circumstances, a further advantage of the carpet in accordance with the invention is that it gives rise to  
15 less drag on the spikes than conventional surfaces formed from bonded rubber particles and may permit a runner to achieve a greater speed, for example.

Reference is made to the drawings, in which:-

Figure 1 shows a section through a surface  
20 constructed by a method according to one embodiment of the invention;

Figure 2 shows a section through a playing surface according to another aspect of the invention; and

Figures 3, 4 and 5 show sections through surfaces  
25 constructed according to other preferred methods of the invention.

Referring to Figure 1, on to a suitably prepared surface 1, which may be soil, sand, or even suitably drained concrete or tarmacadam, is laid a sheet 2 of  
30 polypropylene fibre wadding 18 mm thick and comprising 20% of 15 denier fibres, with the balance of 100 denier fibres. The wadding is formed by needle-punching a random mat of the fibres to produce a smooth base layer 3 of substantially horizontal fibres and an open layer 4 in  
35 which at least 60% of the fibres are vertical or

substantially vertical.

5 A layer of rubber particles 5 sized from 0.25 to 0.75 mm is produced in the open layer 4 to approximately half the height thereof by sprinkling and/or brushing in such a manner as not to flatten the wadding significantly. A layer of sand 6, in the form of rounded grains sized about 0.5 mm, is then introduced into the upper half of the open layer 4, to overlies the rubber particle layer 5.

10 The resulting structure can be used without further cover as a pedestrian surface or sports surface, but an artificial turf may be laid on top, if desired.

15 In an alternative construction, the layer of wadding is enclosed, after filling with sand or rubber particles, in permeable membrane, for example a thin (1 mm) resin-bonded polyester fibre mat. This may form an envelope, in the manner disclosed and claimed in our published European Patent Application No. 93008.

20 Referring to Figure 2, a sports playing surface suitable for use as a running track surface, for example, is laid on a suitably prepared base 10 and comprises needle-punched polyester fibres in which a base layer has been formed by introducing on one side of the needle-punched wadding a layer 11 of an adhesive, which is then cured. The free fibres 12 upstanding from the base layer 1 are sprinkled with rubber particles 13 of a maximum particle dimension of about 0.25 to 0.75 millimetres, and the particles are introduced into the pile by brushing or rubbing. The rubber is suitably a synthetic rubber, and is applied at a density of about 0.5 to 2.5 kgm<sup>-2</sup>.

30 The resultant playing surface of carpet loses no resilience in the introduction of the rubber particles, and maintains its resilience throughout prolonged wear, whereas an unfilled carpet of similar construction

becomes compressed and less resilient with the same amount of wear.

Figure 3 represents a portion of a sports playing surface, for example a soccer pitch. A suitably-drained base 30, for example a layer of sand, is prepared, and a wadding 31 approximately 18 mm thick of a type hereinbefore described with reference to Figure 1, is laid thereon. Sand 32 having rounded grains of maximum dimension up to 2 mm is introduced into the wadding until the wadding is filled to the height of the fibres therein. A conventional artificial turf 33 is then laid on top. The surface is relatively quick and inexpensive to construct, and provides a playing surface favourably comparable with a good quality, good condition, natural turf pitch in its playing characteristics.

Figure 4 shows the use of the wadding of the type hereinbefore described with reference to Figure 1 in a mixed natural and synthetic playing surface. A bed 40 of said or soil or other growth medium is laid on a suitably-drained surface. The wadding 41 is laid on to the bed 40 and is filled with sand, soil or other particulate growth medium, and seeded. The resulting grass plants 42 have their roots 43 within the bed 40, and are protected from damage by the wadding and its particulate filling. The grass is cut, watered and fed in conventional manner, and the surface can be spiked as necessary to maintain the drainage and structure of the turf.

Figure 5 illustrates a variation on the structure illustrated in Figure 4. An area of soil is first excavated to give a shallow pit 50, in the base of which drainage slits 51 are cut and filled with gravel or the like. If necessary, porous drainage pipes may be laid in the bases of the slits. The pit 50 is lined with a layer 52 of a water-permeable membrane, for example a non-woven



synthetic fibre material, and then filled with sand 40.  
The wadding 41 is laid and grass seeded in it in the  
manner hereinbefore described with reference to Figure 4.  
The resulting surface is suitable for use as a soccer  
5 pitch, providing a hard-wearing low-maintenance grass  
turf.

A comparison of the ball-bounce characteristics of  
surfaces prepared in accordance with the invention may be  
made by a simple test, in which a cricket ball and a  
10 soccer ball are dropped from a predetermined height on to  
a surface, and the height of the first bounce is  
measured. Bounce heights are expressed as a percentage  
of the drop height. Firstly, by way of comparison only,  
an envelope containing a layer of sand 37 mm thick was  
15 prepared in the manner described in our published  
European Patent Application No. 93008, on a concrete  
base.

Secondly, a 15 mm thick wadding, of the type  
described herein, having a weight of  $1.1 \text{ kgm}^{-2}$ , and  
20 filled with sand, was used and thirdly, a 15 mm wadding  
filled with rubber particles was used.

The following table gives the bounce heights  
obtained for these surfaces.

TABLE: Comparison of bounce heights

25 <u>Type of System</u>	<u>Soccer Ball</u>	<u>"Vista" Cricket Ball</u>
Concrete	50% to 60%	36% to 40%
Sand Envelope		
on concrete	33% to 40%	10% to 12%
Sand-filled		
30 wadding on		
concrete	33% to 40%	10% to 12%
Rubber-filled		
wadding	42% to 45%	17% to 20%

It will be appreciated that, within the scope of the  
35 invention, surfaces can be produced having widely

differing characteristics and these surfaces may be selected and combined according to the desired use.

5 The weight per square metre of the open fibrous structure may be extremely light, for example as low as 250 grms for a 12 mm thick layer. The structure is therefore not on its own suitable for artificial turf or as an underlay/shock pad and it is only when filled with the particulate material that the desired characteristics are obtained.

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CLAIMS

1. A method of forming a pedestrian, vehicular or sports playing surface or underlay/shock pad structure, characterised by providing within said structure a layer of an open fibrous synthetic material, and distributing a  
5 particulate material throughout the fibrous material whereby the compressibility of the fibrous material is reduced.
2. A method according to Claim 1, characterised in that the particulate material comprises sand or soil.
- 10 3. A method according to Claim 1 or 2, characterised in that the particulate material comprises particles of rubber or a plastics material.
4. A method according to Claim 1, 2 or 3, characterised in that the fibrous material is a needle-punched wadding  
15 formed from synthetic fibres.
5. A method according to Claim 4, characterised in that the wadding has vertical, horizontal and angular fibres 50% to 75% of the fibres being vertical or substantially vertical.
- 20 6. A method according to any preceding claim, characterised in that the thickness of the layer of fibrous material is 4 mm to 37 mm.
7. A method according to Claim 6, characterised in that said thickness is at least 12.5 mm.
- 25 8. A method according to any preceding claim, wherein the particulate material is a growth medium, characterised by cultivating grass or the like in said layer.
9. A method of forming a pedestrian vehicular or sports  
30 playing surface including preparation of a first surface permeable to water, characterised in that a first layer comprising a sheet of open fibrous material having vertical, horizontal and angular fibres of synthetic material is laid on top of the first surface the open

fibrous material being subsequently substantially completely filled with a particulate material to form a composite layer the particulate material being selected to produce a desired compressibility of the composite  
5 layer, and in which a second layer comprising a sheet of artificial turf material is laid on top of the composite layer.

10. A method of forming a pedestrian, vehicular or sports playing surface comprising a mixture of artificial  
10 and natural grass including preparation of a first surface permeable to water characterised in that a layer comprising a sheet of open fibrous material having vertical, horizontal and angular fibres of synthetic material is laid on top of the first surface the open  
15 fibrous material being subsequently substantially completely filled with a particulate material to form a composite layer, and in that grass seed is planted into or included within the particulate material, the sheet of open fibrous material being formed such that the grass  
20 when grown has roots which pass through the fibrous material into the first surface.

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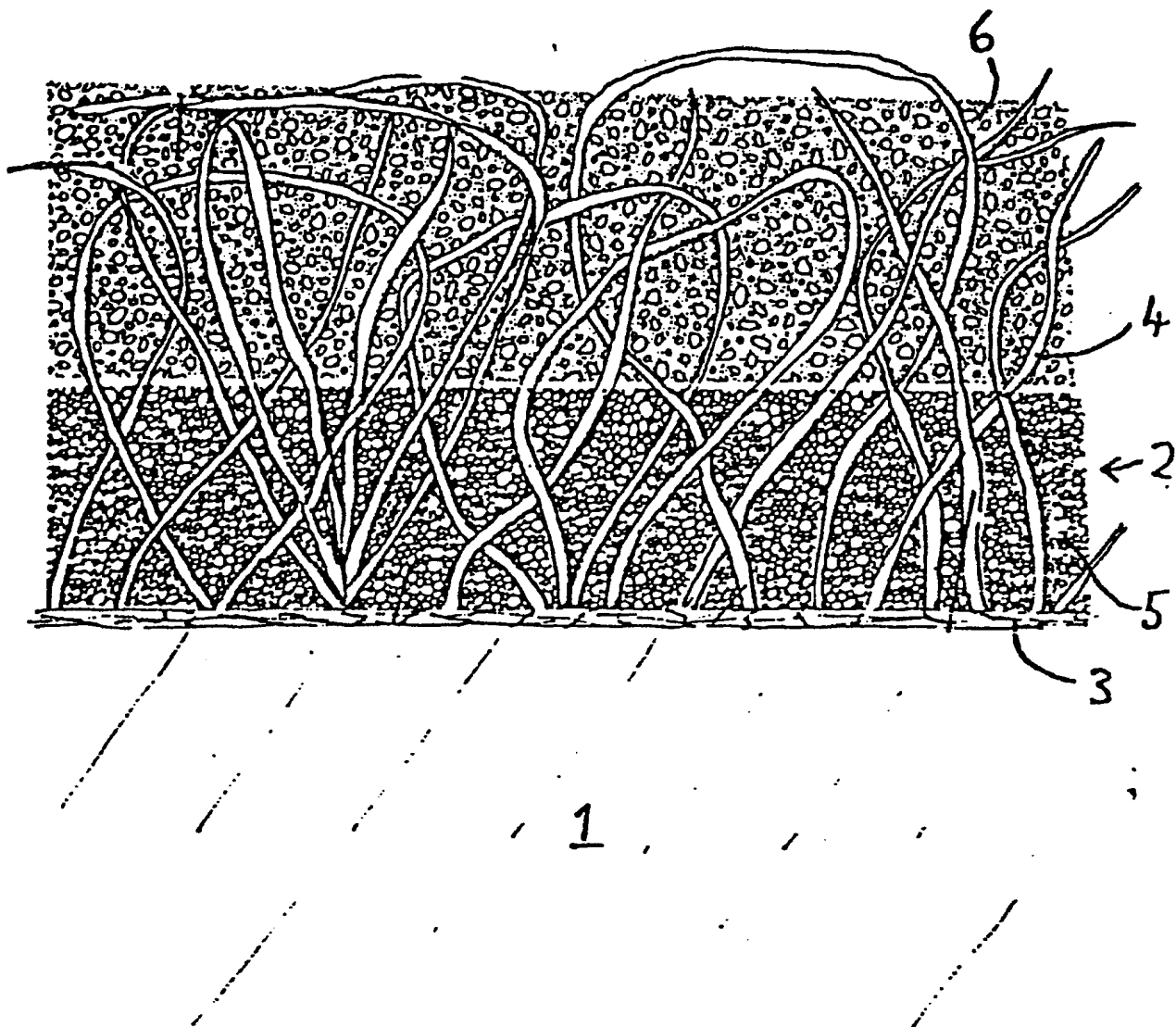
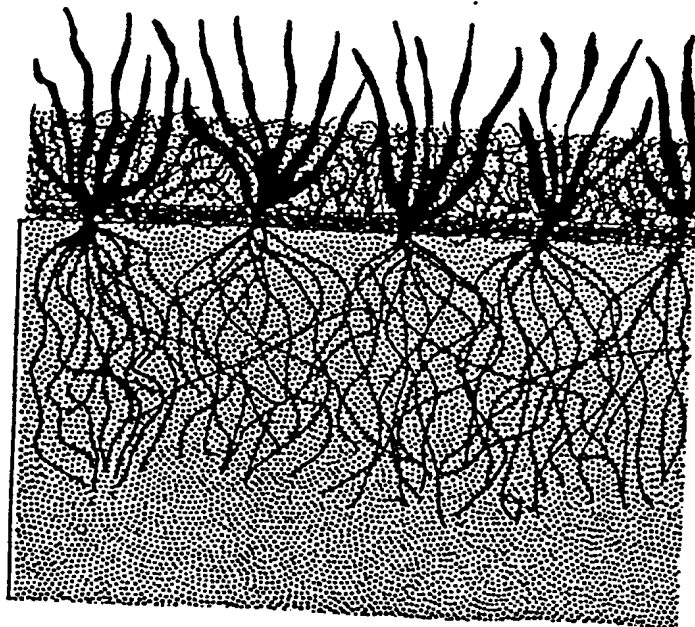
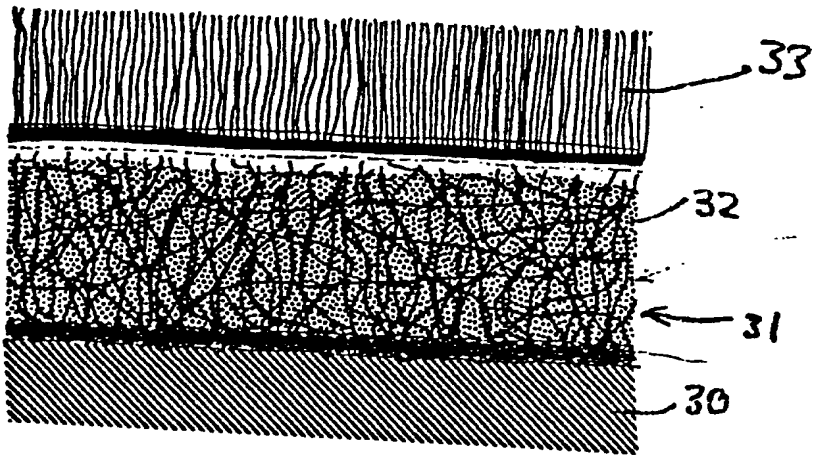
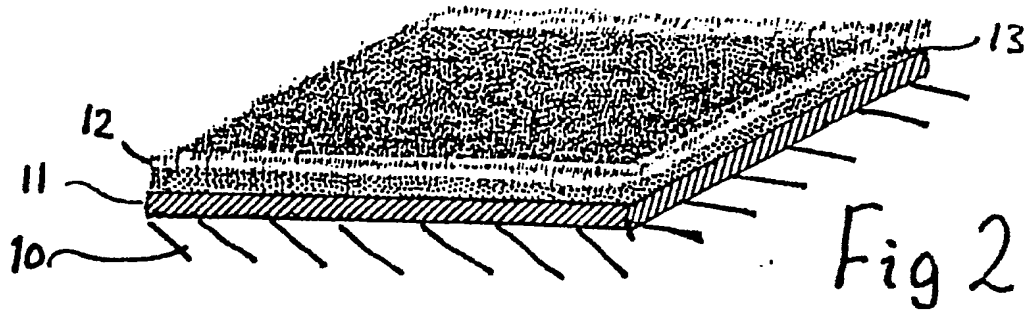


Fig. 1



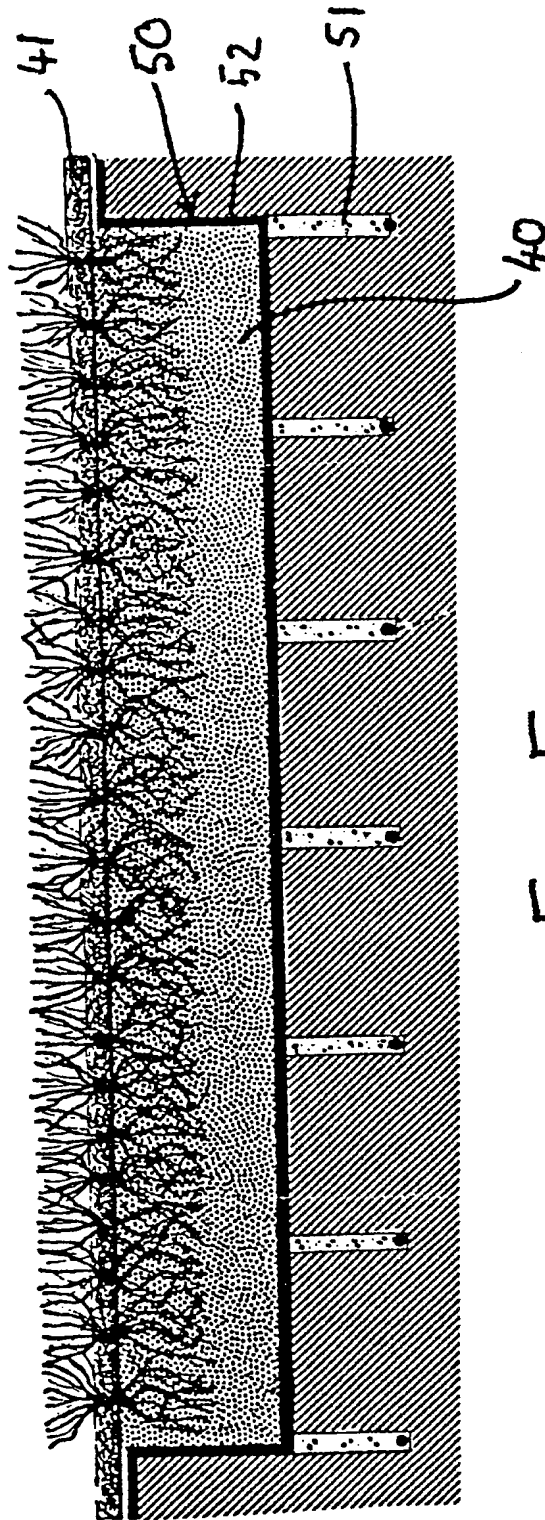


Fig 5



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## EUROPEAN SEARCH REPORT

0174755

Application number

EP 85 30 5906

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	US-A-4 337 283 (HAAS) * Whole document *	1-3, 6, 7	E 01 C 13/00 E 01 C 9/08 E 01 C 15/00 E 01 C 9/00
X	US-A-4 396 653 (TOMARIN) * Whole document *	1-3	
A	US-A-1 906 494 (STEWART) * Page 2, line 101 - page 3, line 107; figures *	1, 4, 5	
A	DE-A-2 522 864 (BERLEBURGER) * Page 10, line 6 - page 11, line 15; page 12, lines 17-25; figures *	1, 8	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			E 01 C E 02 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 02-12-1985	Examiner DIJKSTRA G.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	